STRETCHABLE NONWOVEN FABRIC, FASTENING MATERIAL FOR CLOTHING AND PRODUCTION THEREOF

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Abstract of **JP7300752**

PURPOSE:To produce a fastener for clothing having good stretch recovery, fitting properties and excellent skin touch by using stretchable nonwoven fabric whose stretchability is suppressed in the longitudinal direction. CONSTITUTION:Regular polyester fibers and polyester sheath-core conjugate fibers are uniformly mixed at a ratio of 60% to 40% to form a web in which almost of the fibers are arranged in one direction. Then, across-laid web of polyester latently crimpable fibers are laminated on said web, needle-punched to effect three-dimensional interlace and heat-treated to develop loop crimps, simultaneously the web is stretched in the longitudinal direction to give nonwoven fabric stretchable in the widthwise directions. Or the web of above- described latently crimped yarns is needle-punched, heat-treated to develop loop crimps, impregnated with a stretchable adhesive, stitched with non- stretchable yarns in the longitudinal direction to give nonwoven fabric stretchable in the widthwise direction. The stretchable non-woven fabric is cut in a prescribed shape to give a fastening material for the edges of sleeves, hems, gloves or caps.

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(54) [Title of the Invention]

ELASTIC NON-WOVEN FABRIC, CLOTHING TIGHTENING MATERIAL AND METHODS FOR MANUFACTURING THE SAME

(57) [Abstract]

[Object] The object of the invention of the present application is to provide [a] a tightening material [i] in which an elastic non-woven fabric with restricted elasticity in the warp direction is used so that stretching in the warp direction is suppressed, [ii] which is inexpensive and easily attached, and [iii] which is easily donned, and [b] a method for manufacturing such a material.

[Constitution] The invention of the present application concerns [a] an elastic non-woven fabric with restricted elasticity in the warp direction, especially an elastic non-woven fabric in which the elasticity in the warp direction is restricted by means of loop-form crimped fibers, [b] a tightening material consisting of such an elastic non-woven fabric, and [c] methods for manufacturing such a non-woven fabric and tightening material.

[Claims]

[Claim 1] An elastic non-woven fabric which is characterized by the fact that the elasticity of said fabric in the warp direction is restricted.

[Claim 2] The elastic non-woven fabric claimed in Claim 1, which is characterized by the fact that said non-woven fabric consists of loop-form crimped fibers.

[Claim 3] The elastic non-woven fabric claimed in Claim 1, which is characterized by the fact that said non-woven fabric consists of a three-dimensionally entangled web.

[Claim 4] The elastic non-woven fabric claimed in any of Claims 1 through 3, which is characterized by the fact that said non-woven fabric includes a web which is unidirectional in the warp direction.

[Claim 5] The elastic non-woven fabric claimed in any of Claims 1 through 3, which is characterized by the fact that said non-woven fabric is subjected to a stitching treatment in the warp direction.

[Claim 6] The elastic non-woven fabric claimed in any of Claims 1 through 3, which is characterized by the fact that said non-woven fabric is subjected to thermal press-bonding in the warp direction.

[Claim 7] The elastic non-woven fabric claimed in any of Claims 1 through 3, which is characterized by the fact that the web is stretched in the warp direction.

[Claim 8] The elastic non-woven fabric claimed in any of Claims 1 through 7, which is characterized by the fact that said non-woven fabric is treated with an adhesive agent.

[Claim 9] The elastic non-woven fabric claimed in Claim 8, which is characterized by the fact that the aforementioned adhesive agent possesses elasticity.

[Claim 10] A method for manufacturing an elastic non-woven fabric which is characterized by the fact that a web which has loop-form crimped fibers is three-dimensionally entangled, and then treated with an adhesive agent.

[Claim 11] A method for manufacturing an elastic non-woven fabric which is characterized by the fact that a web which has fibers with latent crimpability is three-dimensionally entangled, after which said non-woven fabric is heat-treated and then treated with an adhesive agent.

[Claim 12] A method for manufacturing an elastic non-woven fabric which is characterized by the fact that a web which has fibers with latent crimpability is three-dimensionally entangled, heat-treated and stretched in the warp direction.

[Claim 13] A method for manufacturing an elastic non-woven fabric which is characterized by the fact that a web with latent crimpability formed by melt-spinning a thermoplastic resin is heat-treated, and is then treated with an adhesive agent.

[Claim 14] A method for manufacturing an elastic non-woven fabric which is characterized by the fact that a web which is unidirectional in the warp direction is included [in the non-woven fabric].

[Claim 15] A method for manufacturing an elastic non-woven fabric which is characterized by the fact that a stitching treatment is performed in the warp direction.

[Claim 16] A method for manufacturing an elastic non-woven fabric which is characterized by the fact that a thermal press-bonding treatment is performed in the warp direction.

[Claim 17] A method for manufacturing an elastic non-woven fabric which is characterized by the fact that the web is stretched in the warp direction.

[Claim 18] The method for manufacturing an elastic non-woven fabric claimed in any of Claims 10, 11 or 13, which is characterized by the fact that the aforementioned adhesive agent possesses elasticity.

[Claim 19] The method for manufacturing an elastic non-woven fabric claimed in any of Claims 10 through 18, which is characterized by the fact that the elastic non-woven fabric is [used as] a clothing tightening material.

[Claim 20] A clothing tightening material for sleeves, cuffs, gloves or hats, etc., which is characterized by the fact that said material consists of the elastic non-woven fabric with restricted elasticity in the warp direction claimed in any of Claims 1 through 9.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Utilization] The invention of the present application concerns an elastic non-woven fabric, a clothing tightening material, and methods for manufacturing said non-woven fabric and tightening material.

[0002]

[Prior Art] Conventionally, tricot knit fabrics have been used as sleeve opening bands or cuff opening bands applied to sleeves or cuffs of clothing articles; such tricot knit fabrics have been joined to the inner or outer circumferences of such sleeves or cuffs. In the case of such tricot knit fabrics, it is necessary to fold the fabric back in order to prevent unraveling of the cut end of the fabric. Accordingly, the tip end of the sleeve opening band or cuff opening band is folded back on the inside, and the folded-back tip end which has assumed a substantially U-shaped configuration is stretched approximately two-fold and overlapped with the tip end of the sleeve or cuff, after which the periphery is stitched.

[0003]

[Problems Which the Present Invention Attempts to Solve] The joining of tricot knit fabrics to the sleeves or cuffs of articles of clothing as sleeve opening bands or cuff opening bands is accomplished by stitching by means of a sewing machine, etc., while applying tension to the tricot knit fabric which has been cut in tubular form. However, since tricot knit fabrics are excessively flexible, folding and handling are difficult in the case of such joining. Consequently, working requires the expenditure of considerable effort, and costs are increased. Furthermore, in cases where tricot knit fabrics are stitched by means of a sewing machine, portions of the tricot knit fabric are cut by the needle of the sewing machine, so that so-called "runs" tend to occur. Moreover, in the case of conventional elastic non-woven fabrics, recovery following stretching is not always sufficient, so that the material does not adhere tightly to the body after the clothing has been worn. Furthermore, in cases where an elastic non-woven fabric is used alone, the elastic non-woven fabric is also stretched in the warp direction when [the garment is] donned, so that donning is difficult. Here, the term "warp direction" refers to the direction of length in the non-woven fabric, or to the direction of sleeve length in the case of sleeve opening bands in clothing, while the term "woof direction" refers to the direction of width in the non-woven fabric, or to the circumferential direction of sleeve opening bands in clothing.

[0004]

[Means Used to Solve the Abovementioned Problems] In order to solve the abovementioned problems, the invention of the present application uses a non-woven fabric with a high elasticity and a high degree of elastic recovery following stretching, in which the elasticity in the warp direction is restricted; more specifically, the invention of the present application uses an elastic non-woven fabric in which an elastic sheet possessing loop-form crimped fibers is treated with an adhesive agent. In concrete terms, the abovementioned elastic non-woven fabric is a non-woven fabric with restricted elasticity in the warp direction, which may be [a] an elastic non-woven fabric consisting of loop-form crimped fibers, [b] an elastic non-woven fabric consisting of a three-dimensionally entangled web, [c] an elastic non-woven fabric which includes a web that is unidirectional in the warp direction, [d] an elastic non-woven fabric which is subjected to a stitching treatment in the warp direction, [e] an elastic non-woven fabric as claimed in any of Claims 1 through 3 which is subjected to thermal press-bonding in the warp direction, [f] an elastic

non-woven fabric in which the web is stretched in the warp direction, [g] an elastic non-woven fabric which is treated with an adhesive agent, or [h] an elastic non-woven fabric in which the aforementioned adhesive agent possesses elasticity. The elastic non-woven fabric of the invention of the present application is suitable for use as a clothing tightening material, and is especially suitable for use in the tightening portions of sleeves, cuffs, collars, hats and gloves, etc. Furthermore, the present invention may be applied to all types of clothing, but is especially suitable for use in disposable clothing used in hospitals, such as surgical gowns, isolation gowns, surgical caps and shoe covers, etc. In such cases, a material which can withstand sterilization treatments by means of electron beams or gamma rays is more desirable.

[0005] Clothing tightening materials consisting of the elastic non-woven fabric of the present invention in which the elasticity in the warp direction is restricted can be manufactured (for example) by [a] a method in which a web which has loop-form crimped fibers is three-dimensionally entangled, and then treated with an adhesive agent, [b] a method in which a web which has fibers with latent crimpability is three-dimensionally entangled, heat-treated and then treated with an adhesive agent, [c] a method in which a web which has fibers with latent crimpability is three-dimensionally entangled, heat-treated and then stretched in the warp direction, [d] a method in which a web with latent crimpability formed by melt-spinning a thermoplastic resin is heat-treated and then treated with an adhesive agent, [e] a method in which a web which is unidirectional in the warp direction is included in the material, [f] a method in which the material is subjected to a stitching treatment in the warp direction, [g] a method in which the material is subjected to a thermal press-bonding treatment in the warp direction, [h] a method in which the web is stretched in the warp direction, or [i] a method in which the material is manufactured using an adhesive agent which possesses elasticity as the adhesive agent, etc. Here, the term "stitching treatment" refers to a treatment in which stitching or knitting is performed with a yarn. In the case of methods in which stretching is performed in the warp direction, a heat treatment and stretching may be performed simultaneously, or one of said treatments may be performed before the other.

[0006] In the case of an elastic non-woven fabric with restricted elasticity in the warp direction, stretching of the elastic non-woven fiber in the warp direction at the time of donning can be suppressed, so that [the garment] can easily be donned.

[0007] Appropriate examples of the elastic non-woven fabric of the present invention include a non-woven fabric in which a web consisting mainly of fibers with latent crimpability is entangled by means of a needle punch or water jet, etc., after which loop-form crimping is realized by means of a heat treatment, etc., a span-bonded non-woven fabric consisting of an elastomer such as a polyurethane, etc., or a non-woven fabric obtained by treating a melt-blown non-woven fabric, etc., with an adhesive agent. Furthermore, non-woven fabrics obtained by forming loop-form crimping in a melt-blown non-woven fabric or span-bonded non-woven fabric obtained by melt-spinning, etc., and then treating the fabric with an adhesive agent, are also appropriate.

[0008] Examples of adhesive agents which can be used include natural rubber, synthetic rubbers such as NBR and SBR, etc., elastomers such as styrene-isoprene-styrene, styrene-butadiene, styrene and urethan type elastomers, etc., synthetic resins such as acrylic resins, ethylene methyl acrylate resins and ethylene vinyl acetate resins, etc., modified forms of such resins, and mixtures of these adhesive agents, etc. It is desirable to use an adhesive agent which possesses elasticity. Furthermore, methods which can be used to treat the non-woven fabric with an adhesive agent include impregnation methods, spray methods, coating methods and printing methods, etc. Especially in the case of printing methods, printing in continuous or discontinuous lines is desirable.

[0009] The non-woven fabric may be used in a single layer, or in the form of two or more layers. By using multiple layers, it is possible to obtain a stronger elasticity. Furthermore, it is desirable that the non-woven fabric have flexibility and elasticity when stretched. The fibers used in the non-woven fabric are mainly synthetic fibers; however, natural fibers or regenerated fibers, etc., may also be mixed with these synthetic fibers. Polyester fibers are especially desirable from the standpoint of sterilization treatments using electron beams or gamma rays. Furthermore, considering perspiration that occurs during surgical procedures, it is also desirable to mix hygroscopic or water-absorbing fibers such as rayon fibers, etc., with the abovementioned fibers.

[0010] In particular, it is desirable that the elastic recovery rate of the elastic non-woven fabric following 70% stretching as a tightening material be 70% or greater (preferably 80% or greater) in the woof direction, i. e., in the circumferential direction. If the elastic recovery rate is less than 70%, sleeve opening bands or cuff opening bands in clothing may stretch out of shape when the hands, etc., are passed through, thus resulting in poor wearing comfort and a poor external appearance. Accordingly, such a low elastic recovery rate is undesirable.

[0011] The joining of such tightening materials to sleeves or cuffs, etc., may be accomplished by ordinary joining methods such as stitching by means of a sewing machine, welding by means of ultrasound, etc., or bonding by means of an adhesive agent, etc.

[0012] **[Measurement Method]** The elastic recovery rate following 70% stretching was measured as follows using a tension tester according to the stretching elasticity rate stipulated in JIS L 1096 (General Fabric Testing Methods). Specifically, a test specimen with a width of 5 cm was pulled at a pulling rate of 20 cm/min from point A in a gripping interval of 10 cm. From point B where the sample was stretched to 70% of the gripping interval (7 cm), the sample was returned at the same speed. In this case, the length between point C (where the stress reached zero) and point A was taken as L (cm), and calculations were performed using the following formula:

Elastic recovery rate following 70% stretching (%) = (7 - L)/7 x 100

[0013]

[Practical Examples of Application] Next, practical examples of application will be described. Furthermore, the invention of the present application is not limited to these practical examples.

Practical Example 1

60% regular polyester fibers (2 denier, length: 64 mm) and 40% core-sheath type composite thermoplastic fibers consisting of two polyester components (4 denier, length: 51 mm) were uniformly mixed, and were then unraveled, thus producing a unidirectional web (A) in which the fibers were substantially oriented. Then, a cross-lay [translit.--Tr.] web (B) consisting of 10% polyester fibers with latent crimpability (2 denier, length: 51 mm) was laminated on the abovementioned web at a ratio of A : B = 1 : 3. This laminated web was entangled by means of a needle punch with a needle density of 50 needles/cm^2; afterward, tension was applied in the warp direction while loop-form crimping was realized by heating the web to 200°C, thus producing a non-woven fabric with a weight of 140 g/m^2 possessing elasticity in the direction of width. Next, this non-woven fabric was cut to a size of 20 x 10 cm with the direction of width as the long sides, and was formed into a sleeve opening band with a circumference of 18 cm (LL size); this sleeve opening band was then stitched to a sleeve. In this case, since the stress during stretching in the warp direction was high compared to that of a tricot knit fabric, the working characteristics with respect to stretching [?] [unclear term--Tr.], cutting and stitching, etc., were superior. The sleeve

opening band thus obtained showed a good fit, and showed no unraveling of the cut end. Furthermore, since the elasticity in the warp direction was restricted as a result of the unidirectional web, there was little stretching in the warp direction when the garment was donned. As a result, donning of the garment could be smoothly accomplished; furthermore, the material had a good feeling on the skin, and the fit on the wrists was good.

[0014] Practical Example 2

A web consisting of 100% polyester type fibers with latent crimpability (2 denier, length: 51 mm) was prepared, and this web was entangled by means of a needle punch with a needle density of 50 needles/cm^2; afterward, the web was heated to 200°C so that loop-form crimping was realized, thus producing an elastic sheet with a weight of 150 g/m^2. Furthermore, this sheet was impregnated with an acrylic binder, and was then dried to produce an elastic non-woven fabric with a weight of 180 g/m^2. Afterward, a stitching treatment was performed at 5 mm intervals in the warp direction using a polyester yarn which did not possess any elasticity. This elastic non-woven fabric was then cut to a size of 20 x 20 cm, and was folded double and stitched so that the length in the warp direction was 10 cm. This sample was then folded to produce a sleeve opening band with a circumference of 18 cm (LL size), and this sleeve opening band was stitched to a sleeve. In this way, a sleeve opening band was obtained which showed a good fit and no unraveling of the cut end, and which was smooth compared to a tricot knit fabric. During donning of the garment, the elasticity of this sleeve opening band in the warp direction was restricted by the stitching treatment, so that there was little stretching in the warp direction when the garment was donned. Accordingly, donning of the garment could be smoothly accomplished; furthermore, the material had a good feeling on the skin, and the fit on the wrists was good.

[0015] Practical Example 3

A web consisting of 100% polyester type fibers with latent crimpability (2 denier, length: 51 mm) was prepared, and this web was entangled by means of a high-pressure columnar water jet; afterward, the web was heated to 180°C so that loop-form crimping was realized, thus producing an elastic sheet with a weight of 85 g/m^2. Furthermore, this sheet was impregnated with an acrylic binder, and was then dried to produce an elastic non-woven fabric with a weight of 105 g/m^2. Next, this elastic non-woven fabric was cut to a size of 18 x 16 cm, and was folded double and stitched so that the length in the warp direction was 8 cm. This sample was then folded to produce a sleeve opening band with a circumference of 16.5 cm (L size), and this sleeve opening band was stitched to a sleeve. In this way, a sleeve opening band was obtained which showed a good fit and no unraveling of the cut end, and which was smooth compared to a tricot knit fabric. Furthermore, when the garment was donned by a person with a wrist size of 18 cm, the elasticity in the warp direction was restricted by the adhesive agent. Accordingly, donning of the garment could be smoothly accomplished; furthermore, the material had a good feeling on the skin, the fit on the wrists was good, and there was little generation of lint. Moreover, the elastic recovery rate of this elastic non-woven fabric following 70% stretching in the woof direction was 86.9%.

[0016] Practical Example 4

A web consisting of 100% polyester type fibers with latent crimpability (2 denier, length: 51 mm) was prepared, and this web was entangled by means of a needle punch with a needle density of 100 needles/cm^2; afterward, the web was heated to 180°C so that loop-form crimping was realized, thus producing an elastic sheet with a weight of 100 g/m^2. Furthermore, this sheet was sprayed with an acrylic binder, and was then dried to produce an elastic non-woven fabric with a weight of 160 g/m^2. Next, this elastic non-woven fabric was cut to a size of 18 x 10 cm, and was formed into a sleeve opening band with a circumference of 16.5 cm (L size); samples of this sleeve opening band

were stitched to the sleeves of a disposable gown. The sleeve opening band thus obtained showed no unraveling of the cut end, and was smooth compared to a tricot knit fabric. Furthermore, when the garment was donned by a person with a wrist size of 18 cm, the elasticity in the warp direction was restricted by the adhesive agent. Accordingly, donning of the garment could be smoothly accomplished; furthermore, the material had a good feeling on the skin, the fit on the wrists was good, and there was little generation of lint. Moreover, the elastic recovery rate of this elastic non-woven fabric following 70% stretching in the circumferential direction was 82.5%.

[0017] Comparative Example 1

A web consisting of 100% polyester type fibers with latent crimpability (2 denier, length: 51 mm) was prepared, and this web was entangled by means of a needle punch with a needle density of 100 needles/cm^2; afterward, the web was heated to 180°C so that loop-form crimping was realized, thus producing an elastic sheet with a weight of 100 g/m^2. This elastic sheet, containing no binder, was cut to a size of 18 x 10 cm, and was formed into a sleeve opening band with a circumference of 16.5 cm (L size); samples of this sleeve opening band were then stitched to the sleeves of a disposable gown. The sleeve opening band thus obtained showed a low elastic recovery rate following stretching when the garment was donned by a person with a wrist size of 18 cm, and showed a poor fit when worn.

[0018] Practical Example 5

A web consisting of 70% polyester fibers with latent crimpability (2 denier, length: 51 mm) and 30% regular polyester fibers (2 denier, length: 64 mm) was prepared, and this web was entangled by means of a needle punch with a needle density of 50 needles/cm^2; afterward, the web was heated to 200°C so that loop-form crimping was realized, thus producing an elastic sheet with a weight of 140 g/m^2. Furthermore, this sheet was sprayed with an acrylic binder, and was then dried to produce an elastic non-woven fabric with a weight of 180 g/m^2. Next, this elastic non-woven fabric was cut to a size of 20 x 10 cm, and was formed into a sleeve opening band with a circumference of 18 cm (LL size). Samples of this sleeve opening band were stitched to sleeves. The sleeve opening band thus obtained showed no unraveling of the cut end, and was smooth compared to a tricot knit fabric. Furthermore, when the garment was donned by a person with a wrist size of 20 cm, the elasticity in the warp direction was restricted by the adhesive agent. Accordingly, donning of the garment could be smoothly accomplished; furthermore, the material had a good feeling on the skin, and the fit on the wrists was good. This elastic non-woven fabric showed an elastic recovery rate of 76.8% following 70% stretching in the circumferential direction.

[0019] Comparative Example 2

A web consisting of 70% polyester fibers with latent crimpability (2 denier, length: 51 mm) and 30% regular polyester fibers (2 denier, length: 64 mm) was prepared, and this web was entangled by means of a needle punch with a needle density of 50 needles/cm^2; afterward, the web was heated to 200°C so that loop-form crimping was realized, thus producing an elastic sheet with a weight of 140 g/m^2. Next, this elastic sheet, containing no binder, was cut to a size of 20 x 10 cm, and was formed into a sleeve opening band with a circumference of 18 cm (LL size); samples of this sleeve opening band were then stitched to sleeves. The sleeve opening band thus obtained showed a low elastic recovery rate following stretching when the garment was donned by a person with a wrist size of 20 cm, and showed a poor fit when worn.

[0020] Practical Example 6

A polyolefin type span-bonded non-woven fabric with latent crimpability was heated to 135°C so

that loop-form crimping was realized, thus producing an elastic sheet with a weight of 75 g/m^2. Furthermore, this sheet was impregnated with a urethane binder, and was then dried to produce an elastic non-woven fabric with a weight of 95 g/m^2. A cap was formed by cutting and stitching using this elastic non-woven fabric.. As a result, there was no unraveling of the cut ends; furthermore, since the elasticity in the warp direction was restricted by the adhesive agent, the elastic recovery rate following stretching was also high. Accordingly, the cap was extremely superior in terms of fit.

[0021]

[Merits of the Invention] The elastic non-woven fabric with restricted elasticity in the warp direction provided by the present invention, and especially the clothing tightening material provided by the present invention, has restricted elasticity in the warp direction. Accordingly, [garments using] this material can easily be donned. Furthermore, in cases where the elastic non-woven fabric is treated with an adhesive agent, the recovery from stretching is good (unlike the recovery of clothing tightening materials consisting of a simple elastic non-woven fabric which contains no adhesive agent); accordingly, the fit is good, and there is little generation of lint. Furthermore, there is no unraveling of cut parts such as that seen in tricot knit fabrics; accordingly, sleeves and sleeve opening bands or cuffs and cuff opening bands of clothing can easily be joined by means of a sewing machine, ultrasound or an adhesive agent, etc., even in the case of a single layer without any folding. Compared to conventional sleeve opening bands or cuff opening bands, the working process is simple, since there is no unraveling of cut ends. Accordingly, clothing with sleeve opening bands or cuff opening bands which show a superior fit can be provided simply and inexpensively. Thus, the present invention is especially effective in disposable clothing, where low cost is required.